

ATTACHMENTS: CONSTRUCTION PROJECT PLANS

ATTACHMENT I-A
RESERVED

**MIXED WASTE EMBANKMENT
CONSTRUCTION PROJECT PLAN**

TABLE 1 - CQA/QC ACTIVITIES

Work Elements

**General Requirements
Foundation Preparation
Clay Liner Material
Clay Liner Test Pad
Clay Liner Placement
HDPE Liners
Granular Fill
Drainage Net
Geotextile
Soil Protective Cover**

ATTACHMENT I-A - CONSTRUCTION PROJECT PLAN FOR MIXED WASTE EMBANKMENT

**TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - GENERAL REQUIREMENTS**

<u>SPECIFICATION</u>	<u>QUALITY CONTROL</u>	<u>QUALITY ASSURANCE</u>
1) BERM MAINTENANCE: The runon/runoff berms shall be surveyed and improved, as required, by July 31 each spring.	Survey the berms at 100 foot intervals and key points. Repair any noted damage and fill low spots to meet the design height.	Review the QC documentation to confirm that the berms are surveyed and improved, as required, each spring.
2) MOVING OR BREACHING A BERM: When moving or breaching a berm, the work must be authorized by the Construction Engineer prior to commencing work. A temporary breach of a berm may be accomplished without a temporary berm, provided the work is completed and the berm replaced the same day.	Review the work to be performed. Document the approval to move or breach a berm on the "Breach of Berm" form.	Review the QC documentation to confirm that the approval to move or breach a berm has been properly documented and that temporary breaches of berms are replaced the same day.
3) NUCLEAR DENSITY/MOISTURE GAUGE CALIBRATION: Each nuclear density gauge shall receive manufacturer calibration prior to use on the project. Probe holes in the clay liner and radon barrier created by the nuclear density gauge shall be filled with dry bentonite.	Perform oven-drying tests to calibrate the nuclear density/moisture gauge. Review the results with the Construction QA Engineer.	Review and approve the results.
4) To ensure proper calibration, an oven-drying test shall be performed jointly		

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with one of every twenty of the nuclear moisture tests.		
5) SAMPLING LOCATIONS FOR LOTS: Each lift shall be divided into testing lots of approximately equal area. The sample location chosen by random numbers, two random numbers shall be employed.	Generate random numbers for each lot by using a calculator or computer with a random number generator. Locate the test location within five feet of the location specified by the random numbers. In areas where lot geometry is odd-shaped, if the sample location is outside the lot, generate two new random numbers.	Review the QC documentation to confirm that the test methods are being chosen by random number.
6) Compliance testing for soil material approval from stockpiles shall be a composite sample from at least two separate locations representative of the portion of the material being sampled. In the case that a visual inspection determines that more than one type of material is present, a representative sample shall be taken for each material present.	Perform the required stockpile sampling.	Review the QC documentation to confirm that sampling is being done in accordance with specification. Perform a minimum of one (1) QA sample.
7) All QA tests shall be performed in close proximity to corresponding QC samples. Any failing QC or QA test	Record sampling locations.	Review correlation between each QA sample and the corresponding QC sample.

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shall result in a failing lot and initiate rework for the lot.		
8) TEST METHODS: All tests shall be performed in accordance with the standard specified in Attachment D of the Design Engineering Report (DER).	Use the test methods in Design Engineering Report to perform the require testing.	Review the QC documentation to confirm that the test methods applied are the methods specified in the Design Engineering Report.
9) ANCHOR TRENCHES: The inside face (the face closest to the centerline of the landfill) of the anchor trench shall be slightly rounded as needed to ensure that no damage to the HDPE liner is caused by the corner.	Observe and document the condition of the anchor trench on Daily Construction Report.	
10) The anchor trenches shall be backfilled in six inch lifts and shall be compacted to 90.0% of a standard proctor. Density testing shall be conducted at a rate of one test per lift per trench.	Observe that the construction of the anchor trench is in accordance with the approved design drawings. Inform the Construction Engineer and Construction QA Officer of any deviations. Conduct in-place density tests of the anchor trench backfill. Approve areas with tests indicating a density at least 90.0% of a standard proctor.	Inspect the completed anchor trenches. Verify that the density tests are performed at the correct frequency and that the documentation has been completed correctly.

ATTACHMENT I-A - CONSTRUCTION PROJECT PLAN FOR MIXED WASTE EMBANKMENT
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - FOUNDATION PREPARATION

<u>SPECIFICATION</u>	<u>QUALITY CONTROL</u>	<u>QUALITY ASSURANCE</u>
<p>11) EXCAVATION: Excavation shall be made to the lines, grades, and dimensions prescribed in the approved foundation Construction Drawings. Any significant over-excavation (greater than one-foot) shall be backfilled with select clay material in maximum 12 inch loose lifts and compacted to 95.0% of Standard Proctor.</p>	<p>Weekly observe the cell excavation. Record observations and corrective actions taken (where required) on the "Daily Construction Report".</p> <p>In areas of over excavation, conduct in-place density tests at a rate of one test per lot and record the results on the "Field Density Test" form. A lot is defined as a maximum of 10,000 square feet of a specified type of material. Test locations shall be chosen on the basis of random numbers.</p> <ul style="list-style-type: none"> a. Approve lots which meet the specified compaction. b. Rework and retest lots not meeting the specified compaction. <p>At least one proctor shall be performed for each material type. Record the location of the sample on the "Sampling Log".</p>	<p>The Quality Assurance review for foundation preparation shall cover each specification in this work element. Review 10% of QC documentation and verify that the tests were performed at the correct frequency.</p>
<p>12) COMPACTION: Compact the foundation to 95.0% of a Standard Proctor.</p>	<p>Conduct in-place density tests at a rate of one test per lot and record the results on the "Field Density Test" form. A lot is defined as a maximum of 10,000 square</p>	

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	<p>feet of a specified type of material. Test locations shall be chosen on the basis of random numbers.</p> <p>a. Approve lots which meet the specified compaction.</p> <p>b. Rework and retest lots not meeting the specified compaction.</p> <p>Proctors shall be performed at a rate of one test per 115,000 square feet for each material type. At least one proctor shall be performed for each material type. Record the location of the sample on the "Sampling Log".</p>	
<p>13) UNSUITABLE MATERIAL: Remove unsuitable material as required. Unsuitable material is non-soil material or soil which cannot be reworked to meet the compaction criteria or contaminated soil (ie. fuel spills). Unsuitable material shall be removed.</p>	<p>Define areas of unsuitable material and advise the contractor that such areas must be removed. Observe the areas once the unsuitable material has been removed. Report corrective action on the "Daily Construction Report". Notify QA of any unsuitable material.</p>	<p>Visually inspect the area to confirm unsuitable material has been removed.</p>
<p>14) FINAL GRADING: The foundation for the clay liner shall be free from soft spots and wet areas. Foundation</p>	<p>Survey the foundation on a 50 ft grid and cell centerline and at key points in the sump and pipe trench. Final survey</p>	<p>Review the final survey data. Verify the frequency of the survey points.</p>

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<p>shall be at or below grade.</p> <p>15) FOUNDATION APPROVAL: The Foundation is to be approved by the Construction QA Officer.</p>	<p>measurements shall be documented and provided to the Construction Engineer and Construction QA Officer.</p> <p>a. Approve foundation that meets the design lines and grade.</p> <p>b. Rework and resurvey areas not meeting the specified grade.</p> <p>Obtain the “Notice of Acceptance” from the Construction QA Officer before construction of the clay liner begins. The Construction Engineer shall provide a copy to the DSHW.</p>	<p>Provide a “Notice of Acceptance” to the Construction Engineer indicating that the foundation meets the required specifications. Verify that a copy of the “Notice of Acceptance” has been provided to the DSHW.</p>

ATTACHMENT I-A - CONSTRUCTION PROJECT PLAN FOR MIXED WASTE EMBANKMENT
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - CLAY LINER MATERIAL SPECIFICATIONS

<u>SPECIFICATION</u>	<u>QUALITY CONTROL</u>	<u>QUALITY ASSURANCE</u>
<p>16) CLEARING AND GRUBBING: Remove vegetation, debris, organic, or deleterious material from areas to be used for borrow. Grubbing depth shall depend on the type of vegetation, debris, organic, or deleterious material on the site. If the area is free of these materials then no clearing and grubbing shall be necessary.</p>	<p>Inspect and digitally photograph the area once clearing and grubbing has been completed. Record observation and corrective action on the "Daily Construction Report". Attach a copy of the photo to the Daily Construction Report. Keep original digital photograph files in the appropriate QC file.</p>	<p>The Quality Assurance review for clay liner material specifications shall cover each specification in this work element. Review 50.0% of the QC documentation and verify that the tests were performed at the correct.</p>
<p>17) MATERIAL: Satisfactory material shall be defined as CL, and ML soils based on the Unified Soil Classification with at least 85.0% passing the No. 200 sieve, a plasticity index (PI) between 10 and 25, and a liquid limit (LL) between 30 and 50. The clay shall also have a dry clod size less than 1 inch.</p>	<p>Perform laboratory classification tests and a Standard Proctor at a rate of 1 test per lot prior to approval of the material in the clay liner. A lot is defined as a maximum of 3,000 cubic yards (minimum 2 per sump) of specified material type. Record the location of the proctor and classification sample on the "Sampling Log".</p> <ol style="list-style-type: none"> a. Approve lots which meet the specified classification. b. Lots not meeting the specified classification removed or can not be used. c. Provide the results of laboratory testing to QA personnel. 	

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18) PROTECTION: The clay borrow material shall be handled such that cross contamination with radioactive waste material or other deleterious material does not occur.	Visually check clay liner materials for contamination by foreign materials. Remove clays which have been contaminated above the specified requirements. Document corrective actions taken (where required) on the "Daily Construction Report".	Perform a visual inspection of the stockpile corresponding with the QC inspection.
19) PROCESSING: This procedure shall be used to provide suitable material for construction of the clay liner.		
20) 1. Apply deflocculant at a rate of 3.5 pounds to 4.0 pounds per 50 cubic feet.	Measure the mixing areas and verify that the application rate of the deflocculant is in accordance to the specifications. Record the size of the mixing areas and the amount of deflocculant applied on the "Daily Construction Report".	
21) 2. Mix the deflocculant thoroughly into the soils by tilling or similar action.	Observe the mixed clay and advise the contractor of areas which are adequately mixed. Inspect the mixed clay, following the mixing process, to ensure no clumps or clods.	
22) DEFLOCCULANT: The		

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WORK ELEMENT - CLAY LINER TEST PAD

<u>SPECIFICATION</u>	<u>QUALITY CONTROL</u>	<u>QUALITY ASSURANCE</u>
deflocculant shall be sodium tripolyphosphate		
23) NOTICE OF TEST PAD CONSTRUCTION: The Test Pad Plan shall be provided to the DSHW prior to the test pad construction. The DSHW shall be notified 24-hours in advance of the start-up of test pad construction.	Notify the DSHW 24-hours in advance of the start-up of test pad construction.	Verify that the DSHW has been notified of the start-up of test pad construction.
24) TEST PAD: An approximately 60 foot by 75 foot large test pad shall be constructed using the procedure proposed for construction of the clay liner. An approximately 5 foot by 5 foot small test pad shall be constructed using the procedure proposed for construction of the clay liner with manually operated compaction equipment.	Daily, observe the construction of test pads. Measure test pads to ensure that they are constructed to the size indicated. Record the test pad size on the "Daily Construction Report".	Daily, observe the construction of the test pads. The Quality Assurance review for clay liner test pad specifications shall cover each specification in this work element. Review 50.0% of the QC documentation and verify that the tests were performed at the correct
25) A new test pad shall be constructed each time there is a significant change in specifications, construction procedures, types of equipment, Contractor's supervisory personnel,	The large test pad shall be divided into three lots per lift (approximately 1,500 square feet per lot). Each lift of the small test pad shall equal	

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unified soil classification, or more than one year has passed since construction of the last test pad.	a lot.	
26) Test pads are to be constructed and tested in accordance with the following specifications:		
27) 1. Place the clay in at least three lifts with a loose material thickness not exceeding twelve inches for the first lift and nine inches for each subsequent lift.	Measure the loose lift thickness, prior to compaction activities, at a rate of 1 visual inspection per lot. Record thicknesses on the "Daily Construction Report".	Perform a minimum of 1 visual inspection per test pad.
28) 2. The clay is to be compacted by equipment proposed for use during construction of the clay liner. There shall be a minimum of four (4) passes of an appropriate compactor.	Record type of equipment used, and number of passes on the "Daily Construction Report".	Perform a minimum of 1 QA visual inspection per test pad.
29) 3. The lifts of clay shall be bonded by:	Verify that there is adequate surface roughness. Document observations on the "Daily Construction Report".	
30) a) providing a roughened surface of the previously constructed clay liner lift to promote good bonding between the new and old lifts. The surface does not require scarification if the	- OR - Verify that the feet on the appropriate compactor are approximately two inches longer than the lift thickness. Record this	

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<p>surface is already rough at the end of compaction of a lift. When scarification is necessary, is should be roughened to a depth of approximately one (1) inch; - OR - 31) b) by compacting with an appropriate compactor with feet approximately two inches longer than the lift thickness.</p>	<p>observation on the "Daily Construction Report".</p>	
<p>32) 4. The clay is to be compacted to at least 95.0% of a Standard Proctor with a moisture content of optimum to 5 percentage points above optimum.</p>	<p>Conduct in-place moisture-density tests at a rate of three tests per lot. The test location shall be chosen on the basis of random numbers within each lot. Record the test result on the "Field Density Test" form.</p> <p>a. Approve lots which meet the specified moisture and compaction. b. Rework and retest lots not meeting the specified moisture or compaction. c. Any additional work under b. shall be included in the Test Pad construction method.</p>	<p>Perform a minimum of 1 QA test.</p>
<p>33) 5. The clay is to be constructed to</p>	<p>Conduct in-place permeability tests at a</p>	<p>Perform a minimum of 1 QA test.</p>

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<p>provide a permeability less than 1×10^{-7} cm/sec. Permeability testing on the bottom lift will be performed at the lift surface. Permeability testing on the second lift will be performed $\geq 2''$ below the lift surface. Permeability testing on the third lift will be performed approximately $\geq 4''$ below the lift surface.</p>	<p>rate of one test per lot per lift. The permeability test shall be run in close proximity to the moisture-density test for each lot. Record the test result on the "Field Permeability Test" form.</p> <p>a. Approve each lift if all lots meet the required permeability.</p> <p>b Rework and retest lots not meeting the specified moisture or compaction.</p> <p>c. Any additional work under b. shall be included in the Test Pad construction method.</p> <p>At the completion of each lift of the test pad a thin-walled tube sample shall be taken in close proximity to one field permeability test per lift for laboratory permeability testing. Record the location of the test in the "Sampling Log".</p>	
<p>34)6. At least one classification (including PI, LL, and gradation test) shall be conducted for each constructed test pad.</p>	<p>Conduct PI, LL, and gradation tests at a rate of one of each type of test per test pad to determine the material classifications.</p>	
<p>35)7. The procedure used to construct</p>	<p>Provide the Utah Registered Professional</p>	<p>Verify that proper approval has been</p>

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the test pad shall be reviewed and approved by the Utah Registered Professional Engineer.	Engineer with copies of the documentation for the test pad for review and approval.	obtained for the test pad from the Utah Registered Professional Engineer and that the necessary construction procedure documents are on the job site for use during clay liner construction. Verify test pad approval has been provided to the DSHW. Document QA concurrence with these documents

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<u>SPECIFICATION</u>	<u>QUALITY CONTROL</u>	<u>QUALITY ASSURANCE</u>
36) LIFT IDENTIFICATION: Each lot and lift shall be given a discrete designation for testing purposes.	Assign a lift identification number to each lift. Use the lift identification number to identify all paper work for that lift.	
37) PLACEMENT: The clay liner shall be compacted using the same type of equipment and compacting procedures that were approved in the test pad.	Daily, observe the clay liner placement. Record the equipment used to place the clay liner, along with any corrective actions taken (where required) on the "Daily Construction Report".	
38) LIFT BONDING: The lifts of clay shall be bonded by:	Verify that the surface of the previously compacted clay liner lift has been scarified as required. Record observations on the "Daily Construction Report".	The Quality Assurance review for clay liner specifications shall be applied to each specification in this work element. Review 50.0% of the QC documentation and verify that the tests were performed at the correct.
39) 1) providing a roughened surface of the previously constructed clay liner lift to promote good bonding between the new and old lifts. The surface does not require scarification if the surface is already rough at the end of compaction of a lift. When scarification is necessary it shall roughen the surface to a depth of approximately on (1) inch.	- OR -	
	Verify that the feet on the compactor are approximately two inches longer than the lift thickness. Record this observation on the "Daily Construction Report".	
40) 2) by compacting with a compactor with feet approximately two inches longer than the lift thickness.		

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<p>41) LIFT THICKNESS: The first lift of uncompacted material shall be no greater than 12 inches. For the remaining lifts, the loose lift thickness shall not exceed the lesser of the minimum lift thickness used to construct the test pad or nine inches. Thickness for the lift shall be established by installing grade poles on at least a 50-foot grid, center line of the sump, and at all key control points. The grade poles must not be installed deeper than 1 inch into the underlying clay liner. The grade poles must be marked at the appropriate depth to establish the thickness. After the thickness for the lift has been checked and approved by QC personnel, the grade poles shall be removed.</p>	<p>Verify that the required lift thickness is achieved as follows:</p> <ul style="list-style-type: none"> a. Ensure that the required frequency for placement of grade poles has been met. b. Compare soil level with the marked level on the grade poles. c. Use a string line where necessary between poles to check for high spots. d. Define out of specification areas and advise the contractor to rework those areas. e. Review areas reworked and approve areas meeting criteria. f. Continue "b" through "d" above until all areas meet criteria. g. Indicate areas meeting criteria in the "Daily Construction Reports." 	<p>Perform a minimum of 1 visual inspection per lift per sump.</p>
<p>42) COMPACTION: Clay liner material shall be compacted to at least 95.0% of Standard Proctor with a moisture content between optimum and 5.0 percentage points over optimum.</p>	<p>Conduct in-place moisture-density tests at a rate of one test per lot and record the results on the "Field Density Test" form. A lot is defined as 200 cubic yards (compacted) of a single lift. The test location shall be chosen on the basis of</p>	<p>Perform a minimum of 1 QA test per lift per sump.</p>

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	<p>random numbers within each lot.</p> <p>a. Approve lots which meet the specified moisture and compaction.</p> <p>b. Rework and retest lots not meeting the specified moisture or compaction until the lot is approved.</p>	
<p>43) PERMEABILITY: Clay liner shall have an in-place permeability less than or equal to 1×10^{-7} cm/sec.</p>	<p>Conduct in-place permeability tests at a rate of one test per lot and record the results on the "Field Permeability Test" form. A lot is defined as 1,000 cubic yards of compacted clay liner. The permeability test shall be performed adjacent to one of the five density tests in the permeability lot.</p> <p>a. Approve lots which meet the specified permeability.</p> <p>b. Rework and retest lots not meeting the specified permeability until the lot is approved.</p>	<p>Visually observe 1 in-place permeability test per sump.</p>
<p>44) LINER DRYING PREVENTION: To prevent the clay liner from drying, water shall be applied to the clay surface on an as needed basis or the liner shall be covered.</p>	<p>Regularly, observe the liner surface for drying. Advise contractor of deficiencies. Record corrective actions taken (where required) on the "Daily Construction Report".</p>	

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WORK ELEMENT – CLAY LINER PLACEMENT**

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45) FROZEN MATERIAL: No clay liner shall be placed above frozen material. In addition, no frozen material shall be processed or placed in the sump.	As needed, observe the area where clay liner is to be placed. If frozen material is observed, cease placement of clay liner. Record the stopping of placement in the "Daily Construction Report".	
46) CONTAMINATION OF CLAY LINER: The clay liner material shall not become contaminated with radioactive waste or deleterious material during construction.	Visually check clay liner for contamination by foreign materials. Remove clays which have been contaminated above the specified requirements.	
47) FINAL GRADING: Final grading shall be from grade to 0.2 feet above grade. Survey on a 50 foot grid, centerline of the sump, and at all key control points.	Survey the clay liner surface on a 50 ft grid and sump centerline at key points. Final survey measurements shall be documented and provided to the Construction Engineer and Construction QA Officer. a. Indicate where the clay liner meets design lines and grades. b. Rework and resurvey areas not meeting the specified grade until the area is approved.	Review the final survey data. Verify the elevations and frequency of the survey points.
48) DSHW INSPECTION: The DSHW	Notify the QA group and DSHW that the	Verify that written approval of the clay

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<p>shall be provided the opportunity to inspect the clay liner prior to covering by being notified at least 24 hours prior to deployment of HDPE liner. Prior to the DSHW inspection, all applicable records must be complete and available to the DSHW Inspector. In addition, a copy of Envirocare's approval document must be provided to the DSHW Inspector upon request, at the time of the DSHW inspection.</p>	<p>clay liner is prepared and ready for inspection at least 24 hours prior to covering. Obtain written authorization on the "Liner Inspection Form" from the DSHW indicating that the clay liner has been inspected.</p>	<p>liner has been obtained by QC prior to the placement of HDPE liner.</p>
<p>49) SPRING START-UP: For clay liner which was not protected by November 15 with 6 inches of clay compacted to a field permeability of 1×10^{-7} cm/sec, or 12 inches of loose clay, retest the last approved lift for permeability and compaction. For lots of the clay liner which fail compaction or permeability, continue by increasing the testing depth by six inches until a passing lift is found. Remove all clay liner in the lot which does not meet compaction or permeability requirements to less than six inches above the passing lift. Rework the lift</p>	<p>The exposed clay liner shall be divided into 10,000 square foot lots.</p> <p>Conduct in-place density tests and permeability tests (i.e. sealed single-ring infiltrometer tests) at a rate of one of each test per lot and record the results on the "Field Density Test" form and "Field Permeability Test" form. The test location shall be chosen on the basis of random numbers.</p> <p>a. Approve lots which meet the specified density and permeability.</p> <p>b. On lots not approved under a, perform three additional sets of density</p>	<p>Review a minimum of 50% of the QC documentation to verify that the tests are being performed at the correct frequency and that the documentation is being completed.</p>

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<p>until it meets compaction and permeability requirement. For areas covered with protective cover by November 15, test the last approved lift for permeability and compaction. For areas of the clay liner which fail compaction or permeability, continue by increasing the testing depth by six inches until a passing lift is found. Remove all clay liner in the area which does not compaction or permeability requirements to less than or equal to six inches above the passing lift. Rework the lift until it meets compaction and permeability requirements.</p>	<p>and permeability tests on the lot. If all three sets of tests meet specified density and permeability requirements, approve the lot. The location of these additional three sets of tests shall be selected on the basis of random numbers.</p> <p>c. For lots not approved under a or b, perform density and permeability tests on the next six inch lift. The location of these tests shall be chosen on the basis of random numbers within each lot.</p> <p>d. Continue testing six-inch lifts until a lift is approved for the lot.</p> <p>e. Rework and retest lots not meeting the specified permeability or compaction requirements.</p> <p>f. Define the scope of rework and methods used. Record on the Daily Construction Report.</p>	
<p>50) NOTE: See Specification Number 55 for Surface Preparation Specifications</p>		
<p>51) CLAY LINER KEYING-IN: Segments of cell clay liner constructed at times more than 30 days apart from each other shall be keyed-in to each other at vertical steps no greater than</p>	<p>Verify that the new liner has been properly keyed-in to the existing liner. Record deficiencies on the "Daily Construction Report". The vertical steps shall not be on a 90-degree angle.</p>	<p>Verify that the keying-in of the liner has been documented. Visually observe at least one key-in.</p>

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WORK ELEMENT – CLAY LINER PLACEMENT

<u>SPECIFICATION</u>	<u>QUALITY CONTROL</u>	<u>QUALITY ASSURANCE</u>
<p>nine inches and at two-feet wide. The vertical height shall be appropriate for the compaction equipment to be used.</p> <p>52) The lifts of clay shall be bonded by:</p> <p>53) 1) providing a roughened surface of the previously constructed clay liner lift to promote good bonding between the new and old lifts. The surface does not require scarification if the surface is already rough at the end of compaction of a lift. When scarification is necessary it shall roughen the surface to a depth of approximately one (1) inch.</p> <p style="text-align: center;">- OR -</p> <p>54) 2) by compacting with a compactor with feet approximately two inches longer than the lift thickness.</p>		

ATTACHMENT I-A - CONSTRUCTION PROJECT PLAN FOR MIXED WASTE EMBANKMENT
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - HDPE LINER

<u>SPECIFICATION</u>	<u>QUALITY CONTROL</u>	<u>QUALITY ASSURANCE</u>
<p>55) LINER SURFACE PREPARATION: Final grading and finishing efforts on the surface of the clay liner shall leave the surface free of sharp objects and deleterious material that might damage the overlying geosynthetics. The surface of the completed clay liner shall be generally regular (i.e. \leq a one inch vertical drop). The surface shall provide a firm foundation (i.e. smooth drum rolled). Rocks or other hard objects that are greater than ¼ inch shall be removed. In addition, any uneven or angular rocks that can be seen at, in, or on the surface shall be removed. Desiccation cracks larger than one-fourth inch wide and one inch deep or deeper shall be filled with dry powdered bentonite.</p>	<p>The QC personnel of the Synthetics Contractor are to observe and approve, in writing, the surfaces which shall form the subgrade for the HDPE liners. The Construction Engineer shall photograph the clay liner or soil protective cover surface immediately prior to deployment of the HDPE liner material.</p>	<p>Verify that an approval, in writing, has been obtained from the Synthetics Contractor. Verify that a photographic record has been obtained prior to deployment of the HDPE liner material.</p>
<p>56) REQUIREMENTS PRIOR TO LINER PLACEMENT: Prior to HDPE liner installation, the Synthetics contractor shall provide to QA and QC personnel:</p>		

ATTACHMENT I-A - CONSTRUCTION PROJECT PLAN FOR MIXED WASTE EMBANKMENT
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - HDPE LINER

<u>SPECIFICATION</u>	<u>QUALITY CONTROL</u>	<u>QUALITY ASSURANCE</u>
<p>57) 1a. Quality Control Certificates: Each roll of liner shall have a unique identification number. QC certificates shall be provided for thickness, tensile properties, tear resistance, puncture resistance and carbon black content at the frequency specified in Appendix B of the Design Engineering Report. The liner shall be composed of virgin raw material with no more than 2% clean reworked materials by weight. Liner whose certificates indicate material which does not meet specification defined in Appendix B of the Design Engineering Report are to be marked conspicuously and removed from the construction area.</p>	<p>Rolls of liner not meeting specification are to be marked conspicuously and moved to a location designated by QA personnel. Rolls of liner shall not be deployed until approval has been received from QA personnel indicating that the rolls meet specifications.</p>	<p>Receive, review and approve the required QC certificates prior to allowing liner to be deployed. Review the required submittals with the QC personnel and the Construction QA Officer. Review and document the approval of each roll of HDPE liner on the "HDPE Liner Roll Approval Form". Review and document the approval of the polymer raw material on the "Polymer Raw Material Approval Form". Provide copies of the "HDPE Liner Roll Approval Form", indicating which rolls of liner were approved to QC personnel.</p>
<p>58) 1b. Polymer Raw Material Certificates: The liner manufacturer is to provide certification that the resin has a minimum density of 0.93 g/cm².</p>		
<p>59) 2. <u>Welding Rod Certification</u>: The welding rod manufacturer is to provide certification that the rod is of the same polymer as the sheet.</p>	<p>Welding rod shall not be used on the project until approval has been received from QA personnel indicating the welding rod certification is acceptable.</p>	<p>Document approval of the welding rod on the "Welding Rod Approval Form". Provide copies to QC personnel.</p>

ATTACHMENT I-A - CONSTRUCTION PROJECT PLAN FOR MIXED WASTE EMBANKMENT
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - HDPE LINER

<u>SPECIFICATION</u>	<u>QUALITY CONTROL</u>	<u>QUALITY ASSURANCE</u>
<p>60) PROCUREMENT AND MANAGEMENT OF HDPE LINER AND WELDING ROD: HDPE liner and welding rod shall not be used on the project until it has been accepted by QC and QA personnel. Acceptance of the material shall be based on receipt and approval of the required certificates and visual observation of the condition of the HDPE liner and welding rod. The HDPE liner and welding rod shall be from the same HDPE resin type. The HDPE liner and welding rod shall not come into contact with the ground, and shall be protected from excessive heat or cold, puncture, cutting, or other damaging or deleterious conditions.</p>	<p>In addition to the procedures above, the following procedures will be followed to ensure that nonconforming liner materials or welding rod are not used on the project:</p> <ul style="list-style-type: none"> a. Together with QA personnel, observe the condition of each roll of HDPE liner and welding rod. b. Ensure the mil thickness is marked conspicuously on each roll of liner. This shall aid in preventing the wrong thickness of liner being mistakenly used during the placement of the primary, secondary, or tertiary liners. c. Mark conspicuously any rolls of liner or welding rod that based on observation or measurement do not conform to the specifications and/or appear to be damaged, and remove them to a location designated by QA personnel. d. Ensure that each roll of liner has been accepted by QA personnel prior to allowing it to be deployed by comparing the "HDPE Liner Roll Approval Form" with the rolls of liners. <p>Ensure that each roll or package of welding rod has been accepted by QA</p>	<p>In addition to the procedures above, the following procedures shall be followed to ensure that nonconforming liner materials or welding rod are not used on the project:</p> <ul style="list-style-type: none"> a. Together with QC personnel, observe the condition of the HDPE liner and welding rod. b. Observe that the mil thickness is marked conspicuously on each roll of liner. c. Document acceptance of each roll of liner on the "HDPE Liner Roll Approval Form". d. Provide QC personnel with copies of the forms indicating acceptance of liner rolls. e. Compare the rolls of liners deployed with the rolls designated for acceptance. Document deployment of the accepted rolls on the "Panel Inspection Form". f. Provide QC personnel with copies of the forms indicating acceptance of the rolls or packages of welding rod. g. Designate a location for non-conforming rolls of liner to be placed sufficiently removed from the construction location so as to ensure the

ATTACHMENT I-A - CONSTRUCTION PROJECT PLAN FOR MIXED WASTE EMBANKMENT

**TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - HDPE LINER**

<u>SPECIFICATION</u>	<u>QUALITY CONTROL</u>	<u>QUALITY ASSURANCE</u>
	personnel prior to allowing it to be used by comparing the "Welding Rod Approval Form" with the rolls or packages of welding rod as they are opened or prepared for use.	non-conforming roll of liner is not inadvertently used.
61) LINER PLACEMENT: Prior to installation, the Synthetics Contractor shall present to the Construction QA Engineer a panel layout plan. The plan is to be prepared based on the HDPE liner panels being placed so as to minimize the number of seams which run parallel to the toe of the 3H:1V slopes within a distance of ten feet from the toe and so as to minimize the number and length of seams in high stress areas of the sump. The HDPE panels shall be placed such that the up-slope panel will overlap the down-slope panel.	Provide a copy of the approved Liner Placement Plan to the DSHW.	The Construction QA Engineer shall approve this plan in writing and include the approval in the QA documentation.
62) To minimize the risk of damage by wind uplift during liner placement, adequate loading on HDPE liner panels shall be provided by sand bags, or other means, which shall not	Observe that the liner is adequately loaded to prevent wind uplift. Ensure liner material is not placed during high winds.	Verify that QC personnel have inspected the liner panels to ensure they are not subject to wind uplift.

ATTACHMENT I-A - CONSTRUCTION PROJECT PLAN FOR MIXED WASTE EMBANKMENT
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - HDPE LINER

<u>SPECIFICATION</u>	<u>QUALITY CONTROL</u>	<u>QUALITY ASSURANCE</u>
<p>damage the liner. Liner material shall not be placed during high winds.</p> <p>63) The liner is to be placed as closely as practical to the panel layout plan. Alterations to the panel layout plan shall not be considered a field design, engineering, or construction change. Thus, a change control procedure shall not be required to make alterations in the panel layout plan during construction. The Construction QA Engineer shall approve all changes to the panel layout plan. Copies of the approved changes for the panel layout shall be forwarded to the DSHW. The as-built drawing shall reflect modifications to the panel layout plan.</p> <p>64) Rolls are to be inspected as they are unwound for holes, blisters, thin spots, undispersed raw materials, or any signs of contamination by foreign material. All defects shall be repaired in accordance to the Liner Repair Specifications.</p>	<p>Observe that the liner is placed in accordance with the approved liner placement plan. Advise the Construction Engineer of the reasons for the proposed modifications. The Construction Engineer shall review proposed modifications with the Construction QA Engineer and both shall either approve or disapprove the modification.</p> <p>Observe the rolls as they are unwound to ensure compliance with the specifications.</p>	<p>The Construction QA Engineer is to review and approve any modifications to the proposed placement plan during construction. If rejected, an alternative plan must be proposed and accepted or the previously approved plan must be followed.</p> <p>Observe the liner as the rolls are unwound for holes, blisters, thin spots, undispersed raw materials, or any signs of contamination by foreign material. Mark the roll number conspicuously on the panel and then more closely inspect the panel for defects. Mark defective areas</p>

ATTACHMENT I-A - CONSTRUCTION PROJECT PLAN FOR MIXED WASTE EMBANKMENT
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - HDPE LINER

<u>SPECIFICATION</u>	<u>QUALITY CONTROL</u>	<u>QUALITY ASSURANCE</u>
<p>65) WELDING: Field welding is to be accomplished by either the fusion method or the extrusion welding method.</p> <p>66) Prior to any welding (with either method) at the beginning of the shift and after lunch or dinner breaks, a pre-weld test shall be run for each technician/equipment combination. In the case of extrusion welding, three coupons shall be taken after cooling. Two coupons shall be tested for shear, and one coupon for peel. In the case of the fusion method, four coupons shall be taken after cooling. Two coupons shall be tested for shear, one coupon for peel of the outer seam, and one coupon for peel of the inner seam. The inner seam is the seam which cannot be seen from</p>	<p>Provide certification that the testing equipment has been calibrated within the past year. Perform pre-weld testing and record results on "Welding Machine Operation Log" form. Ensure problems are corrected and actions taken to correct problems are recorded on the above indicated form. Record the starting and stopping times associated with the operation of each welding machine on the above indicated form.</p> <p>Ensure that the welding machines remain energized (on) with power available throughout the period of welding. If power becomes unavailable or the machine is turned off or otherwise is allowed to cool, another pre-weld certification test must be run.</p>	<p>found for repair or removal. Record results of inspection on "Panel Inspection Form" form. Record that defective areas were repaired on the same form. Review results with the Construction QA Officer.</p> <p>Observe pre-weld testing. Review results recorded on the "Welding Machine Operation Log" form for accuracy and completeness. Ensure that the starting and stopping times associated with the operation of each welding machine is recorded on the above indicated form. Report deficiencies (if any) to QC personnel and the Construction QA Officer. Verify that corrective action has been taken (where required) and recorded on the above form. Record findings of review and the corrective actions taken (where required).</p>

ATTACHMENT I-A - CONSTRUCTION PROJECT PLAN FOR MIXED WASTE EMBANKMENT
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - HDPE LINER

<u>SPECIFICATION</u>	<u>QUALITY CONTROL</u>	<u>QUALITY ASSURANCE</u>
<p>the top surface of the liner. In addition, at the discretion of the Construction QA Engineer, a pre-weld test may be required prior to welding key seams in each pan.</p> <p>67) If any pre-weld test fails, then an additional pre-weld sample shall be made and tested. After any second pre-weld test failure, two consecutive pre-weld samples must be made, tested and have passing results before that particular technician/equipment is put into production welding.</p> <p>68) If an extrudate welding unit has not been used for more than 15 minutes, the unit shall be run until overheated extrudate is removed prior to seaming.</p> <p>69) Seams shall be clean, dry, and have adequate overlap (minimum 3 inches for extrusion welding; 4 inches for fusion welding) prior to welding.</p>	<p>Observe all seams immediately prior to welding to ensure compliance with the specifications.</p>	<p>Observe seams prior to welding to ensure they are clean, dry, and have adequate overlap, as per the specifications. Report deficiencies (if any) to QC personnel and the Construction QA Officer. Verify that corrective action has been taken (where</p>

ATTACHMENT I-A - CONSTRUCTION PROJECT PLAN FOR MIXED WASTE EMBANKMENT
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - HDPE LINER

<u>SPECIFICATION</u>	<u>QUALITY CONTROL</u>	<u>QUALITY ASSURANCE</u>
<p>70) <u>Grinding</u>: Care shall be exercised such that excessive grinding of the liner does not occur as part of the extrusion welding technique. Excessive grinding is defined as one fourth inch (1/4) or more of grind marks showing after the weld is in place, or in the opinion of QA personnel any exposed grind marks that are sufficiently deep to be 10% or greater of the liner nominal thickness. In the event that excessive grinding takes place, then the seam in that area shall be considered defective, and a cap bead shall be placed over the entire seam where the excessive grinding is observed. A cap bead is defined as one additional welding bead parallel to the seam weld, as long as the additional welding bead covers the area of excess grinding. If the additional welding bead does not cover the area of excessive grinding,</p>	<p>Observe the full length of each seam (welded by the extrusion welding technique) for excessive grinding. Ensure that corrective actions required by QA personnel are accomplished.</p>	<p>required) and record observations on "Seam Inspection Form". Review results with Construction QA Officer.</p> <p>Observe the full length of each seam (extrusion welded) for excessive grinding. Report deficiencies (if any) to QC personnel and the Construction QA Officer. Verify that corrective action has been taken (where required) and record observations on the "Seam Inspection Form". Review results with the Construction QA Officer.</p>

ATTACHMENT I-A - CONSTRUCTION PROJECT PLAN FOR MIXED WASTE EMBANKMENT
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - HDPE LINER

<u>SPECIFICATION</u>	<u>QUALITY CONTROL</u>	<u>QUALITY ASSURANCE</u>
<p>then a liner cap shall be placed over that portion of the seam where the welding bead does not cover the area of excessive grinding.</p>		
<p>71) <u>Non-Destructive Seam Testing:</u> Where practicable, all production welding using the fusion method shall be tested using the "Seam Air Pressure Test". All fusion seams not tested by the "Seam Air Pressure Test" and all seams welded by the extrusion method shall be tested by vacuum testing. Procedures for the "Seam Air Pressure Test" and the "Vacuum Test" are presented in appendix E of the Design Engineering Report. The seam also may be divided into sections and each section tested separately.</p>	<p>Perform the non-destructive testing.</p> <p>Should a seam fail the seam air pressure test, the seam may be inspected for leaks, by soaping and pressurizing the seam and checking for bubbles. Any leaks found may be sealed by extrusion welding and the seam retested.</p>	<p>Observe the test and document the results of the non-destructive seam testing on the "Seam Inspection Form". Where defective results are obtained require and verify that the seams are repaired in accordance with the requirement under "Liner Repairs" of this work element. Review daily the "Seam Inspection Form".</p>
<p>72) <u>Destructive Seam Testing:</u> The installed liner shall be destructively tested. Destructive testing is accomplished by cutting a sample of a seam for the purpose of verifying conditions through field and</p>	<p>Obtain samples for destructive testing at the intervals indicated. Document the test results on the "Destructive Testing" form. Divide the sample into three approximately 12 inch x 12 inch samples, one of which is to be tested by QC</p>	<p>Number and then remove each destructive test sampled. Record sampling locations on the "Seam Inspection Form". Review daily the "Destructive Testing" form prepared by QC personnel. Resolve any discrepancies</p>

ATTACHMENT I-A - CONSTRUCTION PROJECT PLAN FOR MIXED WASTE EMBANKMENT
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - HDPE LINER

<u>SPECIFICATION</u>	<u>QUALITY CONTROL</u>	<u>QUALITY ASSURANCE</u>
<p>laboratory testing. One sample for destructive testing shall be cut from seams at a rate of one test for every 500 feet per technician/equipment combination.. Because it is not desirable to take samples from the Sump Leachate Removal Point (SLRP) or other areas where water flows concentrate, QA personnel shall determine the location of the samples. Samples shall be approximately 36 inches by 12 inches and numbered to allow traceability. Sample locations and numbers are to be included on the as-built drawings.</p>	<p>personnel on-site using a calibrated tensiometer, one sample sent to an approved laboratory for testing, and one sample to be archived.</p>	<p>with QC personnel. Send one sample to an approved laboratory for testing in peel and shear. Archive samples (approximately 12 inches x 12 inches or portions thereof) as directed by the Construction QA Officer.</p>
<p>73) The pass/fail criteria for destructive testing shall follow the guidelines below:</p>	<p>Perform field peel and shear testing on coupons taken from the destructive samples noted above. Record the results of the field testing on the "Destructive Testing" form. When the laboratory test results are received, record the results of the laboratory testing on the same form. If either a field or laboratory sample fails the destructive testing then either the entire length of the seam from which the destructive sample has been taken shall</p>	<p>Observe the field peel and shear testing conducted by QC personnel. Determine based on the pass/fail criteria whether or not the field peel and shear tests have passed or failed. Review the "Destructive Testing" form to ensure that the results are immediately and accurately recorded. Obtain copies of the report for the project QA file.</p>
<p>74) <u>Test Criterion for to HDPE Liner Tie-Ins:</u> Film Tear Bond (FTB) and meet the minimum specified values in the Required HDPE Liner Seam Properties table found in Attachment B of the DER. FTB demonstrates that a homogeneous bond is fusing the</p>	<p></p>	<p>Ensure that the destructive testing is</p>

ATTACHMENT I-A - CONSTRUCTION PROJECT PLAN FOR MIXED WASTE EMBANKMENT
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - HDPE LINER

<u>SPECIFICATION</u>	<u>QUALITY CONTROL</u>	<u>QUALITY ASSURANCE</u>
<p>sheets together and that the liner sheet material shall yield before the weld area breaks.</p> <p>75) The criterion for field testing of peel and shear is FTB. Partial peel failures of $\leq 10\%$ are acceptable if the primary mode of failure is FTB.</p> <p>76) For the tie-in to HDPE liner placed in previous phases of construction, the procedure outlined in Section 8.6.7 of the DER shall be followed.</p>	<p>be repaired as specified under "Liner Repairs" of this work element or the area of the defective seam may be isolated by the following procedure:</p> <p>a. Two destructive test samples shall be taken from the same seam at least 10 feet from each side of the original sample. These coupons are to be field tested for peel and shear.</p> <p>b. If any one of those coupons fail to meet the passing criteria, then the entire seam must be capped as specified in "Liner Repair".</p>	<p>completed in accordance with the criteria set forth under the QC column in the event that destructive testing (either laboratory or field) indicates a failure. Note: lab testing can over rule field testing. Accompany QC personnel and designate required repairs or additional sampling locations. Record sampling locations on "Seam Inspection Form". Review daily the "Destructive Testing" form prepared by QC personnel. Resolve any discrepancies with QC personnel.</p> <p>Compare laboratory testing results with the acceptance-rejection criteria to ensure that the welds met the criteria. Review the above indicated forms to ensure that laboratory results have been recorded. Follow procedures indicated above if laboratory results indicate a seam failure.</p>
<p>LINER REPAIRS:</p> <p>77) 1. Holes: Any penetration of the HDPE membrane shall be repaired by capping the area with a HDPE liner cap. The cap shall be vacuum tested. Note: scrapes/scratches that do not penetrate liner shall be repaired with</p>	<p>Perform vacuum tests on the seams of all patches, caps, and beads. Where defective results are obtained; require, verify, and record that seams are repaired and retested. Record results on the liner sheet adjacent to the patches and cap.</p>	<p>Inspect caps prior to welding to ensure that seams are clean, dry, and have adequate overlap, as per the specifications. Observe seams for excessive grinding. Observe the vacuum testing performed by QC personnel.</p>

**ATTACHMENT I-A - CONSTRUCTION PROJECT PLAN FOR MIXED WASTE EMBANKMENT
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - HDPE LINER**

<u>SPECIFICATION</u>	<u>QUALITY CONTROL</u>	<u>QUALITY ASSURANCE</u>
<p>an extrusion weld bead that completely covers the defect.</p> <p>78) 2. Failed Extrusion Welded Seams: Extrusion welded seams which fail non-destructive or destructive field or laboratory testing shall be repaired by capping the seam. Seam caps shall be circular or oval in shape, be of the same HDPE material as the liner, and extend a minimum of six inches over the edge of the area to be capped. The corners of the patches shall have a radius of not less than three inches. Caps shall be extrusion welded and the welds shall be vacuum tested.</p> <p>79) 3. Failed Fusion Seams: Fusion seams which fail non-destructive or destructive field or laboratory testing must be repaired by a) welding the edge of the top liner to the bottom liner using the extrusion method provided the overlap is at least one inch, or b) the seam may be capped as specified under "Failed Extrusion Welded Seams" of this section.</p> <p>80) 4. Destructive Samples: For sample holes in fusion welded seams, the air</p>		<p>Where defective results are obtained, require and verify that seams are repaired and retested. Record and document observations on "Seam Inspection Form" form. Review results with the Construction QA Officer.</p>

ATTACHMENT I-A - CONSTRUCTION PROJECT PLAN FOR MIXED WASTE EMBANKMENT
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - HDPE LINER

<u>SPECIFICATION</u>	<u>QUALITY CONTROL</u>	<u>QUALITY ASSURANCE</u>
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space shall be sealed at both ends of the sample hole. A cap shall be welded over any sample holes specified under "Failed Extrusion Welded Seam". A single cap may be used to cover holes created by a destructive sample and a failed seam.

81) 5. Procedure for Seaming Wrinkles: "Fish-mouths" or wrinkles at the seam overlaps shall be cut along the ridge of the wrinkle back into the panel to effect a flat overlap as directed by the Construction QA Engineer . They shall then be patched with an oval or round HDPE patch extending a minimum of six inches beyond the cut in all directions.

82) **HDPE LINER TIE-IN (WELD DEMONSTRATION TESTING):**
 A demonstration test is performed for HDPE liner tie-in to each HDPE liner layer (or thickness) by:

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TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - HDPE LINER**

<u>SPECIFICATION</u>	<u>QUALITY CONTROL</u>	<u>QUALITY ASSURANCE</u>
<p>83) a. Obtain liner samples from at least three locations, or at least one sample every 500 feet (whichever is greater) along the exposed edge of the previously placed liner adjacent to where liner tie-in shall occur, as determined by QA personnel. Multiple samples shall be taken at each location to evaluate both the fusion and extrusion welding techniques proposed for use during tie-in construction. Each sample shall be at least 5 feet long. Sample locations and numbers shall be included on the as-built drawings.</p>	<p>Daily, during performance of weld demonstration testing, perform a calibration check of the testing equipment and record the results on the "Welding Machine Operating Log" form. Correct any deviations prior to performing testing.</p> <p>Ensure that the welding machines remain energized (on) with power available throughout the period of welding. If power becomes unavailable or the machine is turned off or otherwise is allowed to cool, another weld demonstration trial seam must be run.</p>	<p>Observe the performance of the calibration check of the testing equipment and that the results are properly recorded. Ensure any deviations are corrected prior to performing the weld demonstration testing.</p> <p>Observe the weld demonstration testing. Review the results recorded on the "Welding Machine Operation Log" form for accuracy and completeness.</p>
<p>84) b. Perform weld demonstration trial seams using both the fusion and extrusion methods by seaming the samples obtained from the previously placed liner with the new liner material. Seams shall be clean, dry, and have adequate overlap (minimum 3 inches for extrusion welding; minimum 4 inches for fusion welding) prior to weld demonstration trial seam welding.</p>	<p>Observe all seams immediately prior to welding to ensure compliance with the specifications.</p> <p>Record the starting and stopping time associated with the operation of each welding machine on the "Welding Machine Operating Log" form.</p>	<p>Observe all seams prior to welding to ensure they are clean, dry, and have adequate overlap, as per the specifications. Report deficiencies (if any) to QC personnel and the Construction QA Officer. Verify that corrective action has been taken (where required) and properly recorded.</p>

ATTACHMENT I-A - CONSTRUCTION PROJECT PLAN FOR MIXED WASTE EMBANKMENT

**TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - HDPE LINER**

<u>SPECIFICATION</u>	<u>QUALITY CONTROL</u>	<u>QUALITY ASSURANCE</u>
85)c. After cooling, ten test coupons shall be obtained by QC personnel. Five each of the test coupons shall be tested for shear and peel strength. For the dual fusion method, both the inner and outer seam shall be tested in peel.	Obtain samples for peel and shear testing. Number each sample obtained. Divide the sample into three approximately 12 inch by 12 inch samples, one sample to be tested by QC personnel on-site using a calibrated tensiometer, one sample to be sent off-site for testing by an approved laboratory, and one sample to be archived on-site.	Accompany QC personnel and designate required repairs and sampling locations. Record sampling locations on "Seam Inspection Form". Resolve any discrepancies with QC personnel. Archive one of the samples as directed by the Construction QA Officer.
86)d. The pass/fail criteria for testing of the trial seams shall be the same as that noted above for destructive testing of HDPE liner production and repair seams.	Perform trial seam testing and record results on the "Welding Machine Operating Log" form. Ensure problems are corrected and that any corrective actions taken are recorded.	Determine based on the pass/fail criteria for destructive testing whether or not the weld demonstration trial seam tests have passed or failed.
87) Weld demonstration trial seams shall be performed until passing tests are achieved at each sample location for each type of welding technique (fusion and extrusion). Passing demonstration trial seams shall indicate that acceptable welding is capable of being performed in the field. However, prior to production or repair welding for all tie-in seams, pre-weld qualification testing shall be performed.	When the laboratory test results are received, record the results of the laboratory testing. If either a field or laboratory sample fails any of the testing then additional weld demonstration trial seams shall be performed. Ensure the technique used during the weld demonstration testing (e.g. welding speed, wedge temperature, nip roller force, etc.) is replicated as much as possible during production or repair welding of the liner tie-in.	Compare laboratory testing results with the acceptance-rejection criteria to ensure that the welds met the criteria. Ensure that laboratory results are recorded.

ATTACHMENT I-A - CONSTRUCTION PROJECT PLAN FOR MIXED WASTE EMBANKMENT

**TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - GRANULAR FILL**

<u>SPECIFICATION</u>	<u>QUALITY CONTROL</u>	<u>QUALITY ASSURANCE</u>
88) GRANULAR FILL: Granular fill shall be clean, rounded to subrounded rock with 100% passing a 2.5 inch U.S. sieve. Clean rock shall be defined as material having no more than 10.0% passing the number 40 sieve, and free from all other material not of the same mineralogical nature.	Obtain one laboratory gradation test on every sump (or 200 cubic yards of material). Record compliance, deficiencies and corrective action on the "Daily Construction Report" form. Ensure that corrective actions required by QA personnel are accomplished.	Review 10% of all QC documentation. Verify frequency of laboratory tests and compliance of test results. Report deficiencies (if any) to the Construction Engineer and QC personnel. Verify that corrective action has been taken (where required) and recorded on the "Daily Construction Report" form. Record findings of observations, reviews, and corrective actions taken (where required) on the "Daily Quality Assurance Report". Make an observation during the placement of one SLRP per sump.
89) RUB SHEET: The sump rub sheet must be installed throughout the SLRP prior to granular fill placement.	Verify that the sump rub sheet has been installed.	
90) PERMEABILITY: Granular fill shall have an in-place permeability greater than or equal to 1×10^{-2} cm/sec.	Concurrently with the gradation test, conduct an in-place permeability test at a rate of one test per 2 sumps (400 cubic yards) and record results on the "Field Permeability Test" form. a. Approve areas which meet the specified permeability b. Rework and retest areas not meeting the specified permeability.	Verify that the tests are being performed at the correct frequency and that documentation is being completed.

ATTACHMENT I-A - CONSTRUCTION PROJECT PLAN FOR MIXED WASTE EMBANKMENT

**TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - GRANULAR FILL**

<u>SPECIFICATION</u>	<u>QUALITY CONTROL</u>	<u>QUALITY ASSURANCE</u>
91) THICKNESS: The thickness of granular fill shall be a minimum of one foot. Thickness shall be established by installing grade poles. The grade poles shall be marked at the appropriate depth to establish the thickness. After the thickness has been checked and approved by QC personnel, the grade poles shall be removed.	Verify the required thickness is achieved as follows: <ul style="list-style-type: none">a. Ensure that the required frequency for placement of grade poles has been met.b. Compare granular fill levels with the marked level on the grade poles.c. Use a string line where necessary between the poles to check for high or low spots.d. Define out of specification areas and advise the contractor to rework those areas.e. Review areas reworked and approved areas meeting criteria.f. Continue “b” through “d” above until all areas meet criteria.	Verify that the measurements are being performed at the correct frequency.

ATTACHMENT I-A - CONSTRUCTION PROJECT PLAN FOR MIXED WASTE EMBANKMENT

**TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - DRAINAGE NET**

<u>SPECIFICATION</u>	<u>QUALITY CONTROL</u>	<u>QUALITY ASSURANCE</u>
<p>92) REQUIREMENTS PRIOR TO DRAINAGE NET INSTALLATION: Prior to installation, the manufacturer shall provide the Construction QA Engineer with the quality control certificates (roll and polymer raw materials) pertaining to the drainage net. The material properties and frequency of testing performed to demonstrate compliance with specifications are presented in Attachment B of the DER. Each roll must have a unique manufacturing identification number that shall be recorded.</p>	<p>No action required.</p>	<p>Receive, review and approve required QC certificates prior to allowing drainage net to be deployed. Review the results of the required submittals with the QC personnel. Document roll numbers and quality control certificates received on the "Drainage Net Approval Form". Review form with the QC personnel. Mark conspicuously rolls of drainage net not meeting the specifications and require that they be removed from the construction area. In the comments column on the above indicated form note any rolls not meeting specifications and document that those rolls have been removed from the construction area.</p>
<p>93) PROCUREMENT AND MANAGEMENT OF DRAINAGE NET: Drainage net shall not be used on the project until it has been accepted by Construction QA Engineer. Acceptance of the material shall be based on receipt and approval of the required certificates as discussed in "Requirements Prior to Drainage Net Placement," and visual</p>	<p>Observe and document the condition of each roll of drainage net</p> <p>Ensure that each roll of drainage net has been accepted by QA personnel prior to allowing it to be deployed by comparing the "Drainage Net Approval Form" with the rolls of drainage net.</p>	<p>In addition to the procedures above, the following procedures shall be followed to ensure that nonconforming drainage net materials are not used on the project:</p> <ul style="list-style-type: none">a. Together with QC personnel, observe the condition of each roll of drainage net.b. Document acceptance of each roll of drainage net on the "Drainage Net Approval Form".c. Provide QC personnel with copies of

ATTACHMENT I-A - CONSTRUCTION PROJECT PLAN FOR MIXED WASTE EMBANKMENT

**TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - DRAINAGE NET**

<u>SPECIFICATION</u>	<u>QUALITY CONTROL</u>	<u>QUALITY ASSURANCE</u>
<p>observation of the condition of each roll of drainage net. The drainage net shall not come into contact with the ground and shall be protected from excessive heat or cold, or other damaging or deleterious conditions.</p>		<p>the forms indicating acceptance of the drainage net rolls.</p> <p>d. Ensure that any rolls of drainage net not meeting specifications are marked conspicuously. Designate a location for non-conforming rolls of drainage net to be placed sufficiently removed from the construction location so as to ensure that the non-conforming rolls of drainage net are not inadvertently used.</p>
<p>94) DRAINAGE NET: Prior to covering the HDPE liner with drainage net, the individual seams and panels must be approved by the Construction QA Engineer. Prior to deployment of the drainage net, the underlying HDPE liner is to be clear of soil or deleterious material. Following deployment, the drainage net shall be covered in a timely manner so as to prevent clogging from debris or foreign material that would inhibit the transmissivity of the drainage net</p>	<p>Verify that each panel and seam to be covered has been approved by QA. Observe and photograph the HDPE liner prior to drainage net placement to ensure that the liner has been cleared of dirt and deleterious material. Observe the drainage net placement.</p>	<p>Document the approval of HDPE panel and seams on the "Panel Inspection Form" and the "Seam Inspection Form". Observe areas daily for compliance with the specifications. Report deficiencies (if any) to QC personnel and the Construction QA Engineer. Verify that corrective action has been taken (where required) and recorded on the "Daily Quality Assurance Report." Document the completion of corrective actions and the approval by QA. Record findings of observations, review, and corrective actions taken (where required) in the "Daily Quality Assurance Report".</p>

ATTACHMENT I-A - CONSTRUCTION PROJECT PLAN FOR MIXED WASTE EMBANKMENT

**TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - DRAINAGE NET**

<u>SPECIFICATION</u>	<u>QUALITY CONTROL</u>	<u>QUALITY ASSURANCE</u>
95) The drainage net shall be installed by hand to prevent damage to the surface of the sump or the underlying synthetic liners. Adjacent rolls shall be joined by overlapping the edges by a minimum of four inches. Adjacent rolls shall be connected by tying adjacent rolls together. the tying material shall be a polymer braid or polymer cable ties of a different colored material than the drainage net. Securing of the ties shall not damage the underlying or overlying HDPE liner.	Observe placement and joining of adjacent rolls of drainage net for compliance with the specifications. Advise Synthetics Contractor of deficiencies. Require deficiencies to be corrected prior to covering the net on the "Daily Construction Report".	Observe areas daily for compliance with the specifications. Report deficiencies (if any) to QC personnel and the Construction Engineer. Verify that corrective action has been taken (where required) and recorded on the "Daily Construction Report" indicating documentation is adequate, correct, and has been accepted by QA. Record findings of observations, review, and corrective actions taken (where required) in the "Daily Quality Assurance Report". Document approval of each placed drainage net layer on the "Daily Quality Assurance Report".

ATTACHMENT I-A - CONSTRUCTION PROJECT PLAN FOR MIXED WASTE EMBANKMENT
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - GEOTEXTILE

<u>SPECIFICATION</u>	<u>QUALITY CONTROL</u>	<u>QUALITY ASSURANCE</u>
<p>96) REQUIREMENTS PRIOR TO GEOTEXTILE INSTALLATION: Prior to installation, the manufacturer shall provide the Construction QA Engineer with the quality control certificates (roll number, unit mass, and strength) pertaining to the geotextile. The material properties and frequency of testing performed to demonstrate compliance with specifications are presented in Appendix B of the Design Engineering Report. Each roll must have a unique manufacturing identification number that shall be recorded.</p>	<p>No action required.</p>	<p>Receive, review and approve required QC certificates prior to allowing geotextile to be deployed. Review the results of the required submittals with the QC personnel. Document roll numbers and quality control certificates received on the "Geotextile Approval Form". Mark conspicuously rolls of geotextile not meeting the specifications and require that they be removed from the construction area. In the comments column on the above indicated form note any rolls not meeting specifications and document that those rolls have been removed from the construction area.</p>
<p>97) PROCUREMENT AND MANAGEMENT OF GEOTEXTILE: Geotextile shall not be used on the project until it has been accepted by the Construction QA Engineer. Acceptance of the material shall be based on receipt and approval of the required certificates as discussed in "Requirements Prior to Geotextile Installation" and visual</p>	<p>The following procedures shall be followed to ensure that nonconforming geotextile materials are not used on the project:</p> <ul style="list-style-type: none"> a. Together with QA personnel, observe the condition of each roll of geotextile and observe that the tag or printing on each roll indicates that the roll is the type that has been specified. b. Rolls of geotextile not meeting 	<p>The following procedures shall be followed to ensure that nonconforming geotextile materials are not used on the project:</p> <ul style="list-style-type: none"> a. Together with QC personnel, observe the condition of each roll of geotextile and observe that the tag or printing on each roll indicates that the roll is the type that has been specified. b. Ensure that any rolls of geotextile

ATTACHMENT I-A - CONSTRUCTION PROJECT PLAN FOR MIXED WASTE EMBANKMENT

**TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - GEOTEXTILE**

<u>SPECIFICATION</u>	<u>QUALITY CONTROL</u>	<u>QUALITY ASSURANCE</u>
observation of the condition of each roll of geotextile.	specifications are to be marked conspicuously and moved to a location designated by QA personnel.	not meeting specifications are marked conspicuously. Designate a location for non-conforming rolls of geotextile to be placed sufficiently removed from the construction location so as to ensure the non-conforming roll of geotextile is not inadvertently used.
98) GEOTEXTILE STORAGE: All geotextile shall be covered in storage to protect them from damage (e.g due to sunlight). The geotextile shall be stabilized against ultra violet light (UV) degradation for a minimum of the greater of fourteen (14) days or the manufacturers recommendations. For rolls of geotextile which have not been protected from sunlight, the outer two wraps of geotextile shall be removed and discarded as protective cover for the geotextile.	Provide daily inspections to ensure that the stored geotextiles are covered and protected from sunlight. Mark rolls for which the outer two wraps must be removed and discarded. Record observations and corrective actions taken (where required) on the "Daily Construction Report".	Review daily reports generated by QC personnel. Record findings of observations, review, and corrective actions taken (where required) on the "Daily Quality Assurance Report". Ensure the rolls for which the outer wraps must be removed and discarded have been sufficiently marked to prevent inadvertent use.
99) GEOTEXTILE INSTALLATION: The geotextile shall be installed by hand to prevent damage to the synthetic liners or drainage net. The	QC for geotextile shall be accomplished by Envirocare QC Engineering Technicians. Observe the geotextile placement. Observe placement and	Observe areas daily for compliance with the specifications. Review daily reports generated by QC personnel. Record findings of observations, reviews and

ATTACHMENT I-A - CONSTRUCTION PROJECT PLAN FOR MIXED WASTE EMBANKMENT

**TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - GEOTEXTILE**

SPECIFICATION

geotextile shall be loaded to prevent wind uplift until the placement of the overlying layer. Adjacent rolls shall be joined by overlapping the edges by a minimum of three inches. Adjacent rolls shall be connected by sewing or fusion welding adjacent rolls together. If adjacent rolls are not connected, the minimum overlap of the edges shall be twelve inches.

QUALITY CONTROL

joining of adjacent rolls of fabric for compliance with the specifications. Advise the Synthetics Contractor of any deficiencies. Require deficiencies to be corrected prior to covering the fabric with the soil cover. Perform a final inspection and photograph or video the geotextile prior to placement of the soil cover. Record observations and corrective actions taken (where required) on the "Daily Construction Report."

QUALITY ASSURANCE

corrective actions taken (where required) on the "Daily Quality Assurance Report". Review daily reports generated by QC personnel. Record findings of observations, review, and corrective actions taken (where required) on the "Daily Quality Assurance Report".

ATTACHMENT I-A - CONSTRUCTION PROJECT PLAN FOR MIXED WASTE EMBANKMENT

**TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – SOIL PROTECTIVE COVER**

SPECIFICATION

100) **MATERIAL:** Satisfactory soil protective cover materials are sand and clay. Deleterious material for soil protective cover shall be defined as metal, concrete, hard plastic, or any other material that may potentially damage the underlying or overlying synthetic layers. With notification to the DSHW, waste free of deleterious material is approved for use in the upper soil protective cover layer.

101) **SOIL PROTECTIVE COVER:** Equipment used in placing the soil protective cover shall be restricted to the types of equipment (or equipment with equivalent loading characteristics, i.e. weight, center of gravity, etc.) approved in the DER, or other equipment approved by the Construction Engineer, with notification to the DSHW for equivalent equipment and concurrence of the DSHW for new types of equipment, prior to its use in the sump.

QUALITY CONTROL

Visual Classification. Advise contractor which materials may be used. Document the visual classification of the placed material on the “Daily Construction Report”.

Receive and review equipment lists from the construction contractor that is proposed for placement of the soil protective cover. Any deviations from the approved list in the specifications are to be reviewed by the Construction Engineer prior to allowing the contractor to use the equipment in the cell. Verify DSHW notification of any deviation of equipment from the approved list in the specifications. The Construction Engineer shall document review and approval of the contractors equipment list in the “Daily Construction Report”. A copy of this approval shall be given to the contractor and to QC and QA personnel.

QUALITY ASSURANCE

The Construction QA Engineer shall review the approval of the equipment list for placement of the soil protective cover.

ATTACHMENT I-A - CONSTRUCTION PROJECT PLAN FOR MIXED WASTE EMBANKMENT

**TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – SOIL PROTECTIVE COVER**

<u>SPECIFICATION</u>	<u>QUALITY CONTROL</u>	<u>QUALITY ASSURANCE</u>
102) The soil protective cover shall be pushed out in front of the equipment used to place the cover such that the following minimum cover thicknesses are maintained at all times between the geotextile and the wheels or tracks of the equipment used to place the cover:	Observe and photograph the placement of the soil protective cover daily for compliance with the specifications. Require that the grade poles be installed as the soil cover is placed and that all grade poles are removed after thickness approval. Advise the contractor of any deficiencies. Require all deficiencies to be corrected. Record observations and corrective actions taken (where required) on the "Daily Construction Report."	Observe the sump construction areas at least once per soil cover layer for compliance with the specifications. Review 10% of QC documentation. Report deficiencies (if any) to QC personnel and the Construction Engineer. Record findings of observations, review, and corrective actions taken (where required) on the "Daily Quality Assurance Report".
103) 1. Two (2) feet for dozer tractors, front end loaders, motor graders, and excavator/backhoes.		
104) 2. Two and one half (2.5) feet for trucks hauling the soil cover into the cell for placement.		
105) 3. One (1) foot for small self propelled smooth drum rollers small rubber tire loaders, and equipment approved for highway travel.		
106) 4. Four (4) inches for hand compactors.		
107) No compaction or moisture requirements are specified for the soil cover. Native sand shall be placed around the leachate withdrawal pipes. Placement of the sand around the leachate withdrawal pipes shall be	Verify sand soil cover is placed around the leachate removal pipes and document on the "Daily Construction Report".	

ATTACHMENT I-A - CONSTRUCTION PROJECT PLAN FOR MIXED WASTE EMBANKMENT

TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – SOIL PROTECTIVE COVER

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
done with hand tools.		
108) FINAL GRADING: Grade for the soil protective cover shall be established by installing plastic grade poles on at least a 50-foot grid and at all key control points. The grade poles must be conspicuously marked at the appropriate compliance depth to establish the thickness. Soil cover thickness shall be visually verified at the grade poles.	Verify that the required soil cover thickness is achieved as follows: a. Ensure that the required frequency for placement of grade poles has been met. Record the number of grade poles placed. b. Compare soil level with the marked level on the grade poles. c. Use a string line where necessary between poles to check for high or low spots. d. Define out of specification areas and advise the contractor to rework those areas. e. Review areas reworked and approve areas meeting criteria. f. Continue "b" through "d" above until all areas meet criteria. g. Indicate areas meeting criteria in the "Daily Construction Reports." Verify removal of all grade poles from the approved areas.	
109) NOTE: See Specification Number 55 for Liner Surface Preparation.		
110) All construction activities not described in the DER shall be reviewed and approved with this Manual.		